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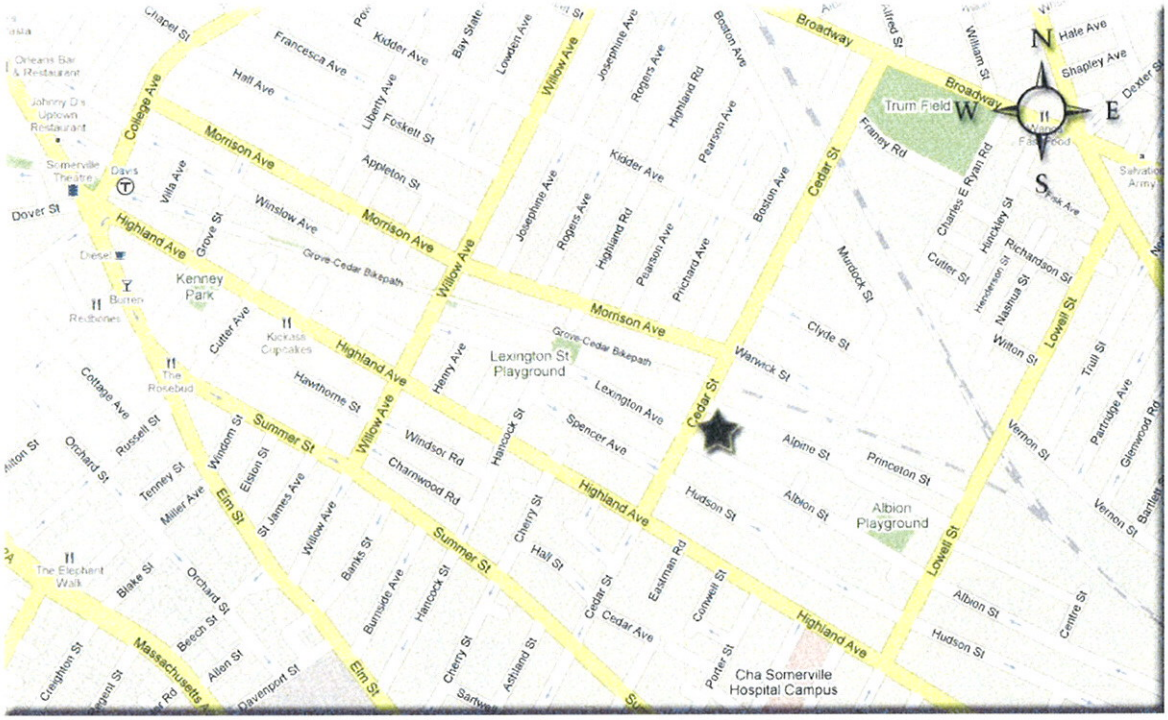
# DRAINAGE REPORT
# FOR
# 143 & 145 CEDAR STREET
# SOMERVILLE, MA

## FEBRUARY 2010





*Prepared for:*

**P.M.D. Group, LLC**
**Somerville, MA**

# Table of Contents

I. Project Descriptions:

This report represents a hydrologic study of the proposed site redevelopment of three existing lots at 143 and 145 Cedar Street in Somerville, MA. The proposed redevelopment will consist of the demolition of the existing 1-story buildings and constructing a new 4-story residential building with surface and garage parking. Site access will be provided by modifying the existing curb cut on Alpine Street.

The purpose of this hydrologic study is to insure that the proposed improvements of this site meet the requirements of the City of Somerville's Rules and Regulations. This report is based upon the rules and regulations of City of Somerville and field observation. This report does not reflect any future proposed drainage system outside of the site limits.

II. Hydraulic Data:

The methodology used in this report is based on the Rational Method, which assumes constant uniform rainfall intensity during the storm interval. A hydrological modeling was performed to determine the existing and future proposed runoff peak discharges for the immediate area. The peak design frequencies for the 2-year, 10-year, 25-year and the 100-year events were used to evaluate the proposed changes. The results of these calculations for both existing and proposed conditions are included in Appendix A of this report.

III. Soils:

No site specific soil information is available at this time. It is expected that, like most of the metropolitan area, soils consist of urban fill. Infiltration is not proposed. Therefore soil conditions and groundwater elevations are not applicable to the drainage design. Soil investigation for the purpose of drainage design is not anticipated.

IV. Hydrologic Analysis:

*PRE-DEVELOPMENT*

Buildings and pavement cover approximately 84% of the existing site. The remaining area is unmaintained landscaping. The topography slopes gently from the southeast to the northwest. The buildings do not have gutters or any other collection system. Paved areas have no drains for collection and treatment. All site runoff flows over the surface and enters the municipal stormdrain.

There is a 42" municipal stormdrain located in Cedar Street, as well as a dedicated stormdrain in Alpine Street that connects with the 42" in Cedar. Estimated pre-development runoff rates and volumes to the stormdrain are shown in Table 1 below:

Table 1
Time of Concentration = 6 Min.
Peak Discharges & Volumes

| Description | Pre-Development | Post Development |
|---|---|---|
| Drainage Area | 0.22 Ac. | 0.22 Ac |
| Curve Number | 0.82 | 0.78 |
| Time of Concentration | 6 Min. | 6 Min. |
| Peak Discharge | | |
| 2-Year | 0.54 cfs | 0.51 cfs |
| 10-Year | 0.81 cfs | 0.77 cfs |
| 25-Year | 1.01 cfs | 0.96 cfs |
| 100-Year | 1.41 cfs | 1.34 cfs |
| Volume | | |
| 2-Year 24 hr | 2,322 cu ft | 2,209 cu ft |
| 10-Year 24 hr | 3,573 cu ft | 3,398 cu ft |
| 25-Year 24 hr | 4,466 cu ft | 4,248 cu ft |
| 100-Year 24 hr | 6,252 cu ft | 5,947 cu ft |

*POST-DEVELOPMENT*

The proposed site improvements include a new 4-story residential building, with a footprint of approximately 3,730sf and approximately 3,340 sf of pavement that will cover 74% of the site. Because of a 10% reduction of impervious area no mitigation is required. The peak runoff rate and total runoff volume will be decreased by the increased surface infiltration capacity. A deep sump, hooded catch basin will collect runoff from the driveway and parking area, providing water quality treatment prior to entering the municipal system. Roof runoff will be collected internally and discharged directly to the municipal system in Cedar Street.

## V. 4 to 1 Infiltration/Inflow Removal

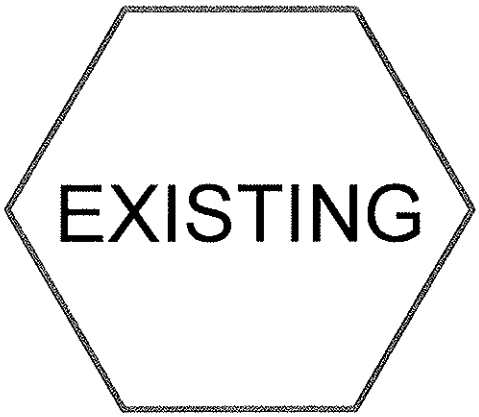
Calculations showing compliance with the City's 4 to 1 I/I Removal policy are provided in Appendix B of this report.

## VI. Conclusion:

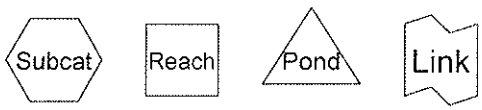
The stormwater runoff in the proposed condition is an improvement from the existing condition with respect to peak rate, quantity, and quality. Proposed site improvements reduces impervious area, resulting in an approximately 4-5% decrease of the peak runoff rate and total runoff volume for all storm events. Runoff quality will be greatly increased as there is no existing treatment prior to running offsite to the municipal stormdrain system. The proposed deep sump catch basin, with proper maintenance, should provide 25% TSS removal.

## APPENDIX A

Pre-Development and Post-Development Drainage Calculations




# 143-145 Cedar Street
# Existing




Drainage Diagram for EXISTING
Prepared by DESIGN CONSULTANTS, INC 12/23/2009

## Subcatchment EXISTING: 143-145 Cedar Street Existing

Runoff = 0.54 cfs @ 0.08 hrs, Volume= 168 cf, Depth> 0.18"

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-0.18 hrs, dt= 0.01 hrs
MA-Boston 2-Year Duration=5 min, Inten=3.25 in/hr

| Area (sf) | C | Description |
|---|---|---|
| 9,400 | 0.90 | Buildings and Pavement |
| 1,492 | 0.35 | Grass and Dirt |
| 10,892 | 0.82 | Weighted Average |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 6.0 | | | | | **Direct Entry,** |

## Subcatchment EXISTING: 143-145 Cedar Street Existing

Runoff = 0.81 cfs @ 0.08 hrs, Volume= 253 cf, Depth> 0.28"

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-0.18 hrs, dt= 0.01 hrs
MA-Boston 10-Year Duration=5 min, Inten=4.90 in/hr

| Area (sf) | C | Description |
|---|---|---|
| 9,400 | 0.90 | Buildings and Pavement |
| 1,492 | 0.35 | Grass and Dirt |
| 10,892 | 0.82 | Weighted Average |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 6.0 | | | | | **Direct Entry,** |

## Subcatchment EXISTING: 143-145 Cedar Street Existing

Runoff = 1.01 cfs @ 0.08 hrs, Volume= 315 cf, Depth> 0.35"

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-0.18 hrs, dt= 0.01 hrs
MA-Boston 25-Year Duration=5 min, Inten=6.10 in/hr

| Area (sf) | C | Description |
|---|---|---|
| 9,400 | 0.90 | Buildings and Pavement |
| 1,492 | 0.35 | Grass and Dirt |
| 10,892 | 0.82 | Weighted Average |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 6.0 | | | | | **Direct Entry,** |

## Subcatchment EXISTING: 143-145 Cedar Street Existing

Runoff = 1.41 cfs @ 0.08 hrs, Volume= 439 cf, Depth> 0.48"

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-0.18 hrs, dt= 0.01 hrs
MA-Boston 100-Year Duration=5 min, Inten=8.50 in/hr

| Area (sf) | C | Description |
|---|---|---|
| 9,400 | 0.90 | Buildings and Pavement |
| 1,492 | 0.35 | Grass and Dirt |
| 10,892 | 0.82 | Weighted Average |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 6.0 | | | | | **Direct Entry,** |

## Subcatchment EXISTING: 143-145 Cedar Street Existing

Runoff = 0.03 cfs @ 0.10 hrs, Volume= 2,322 cf, Depth= 2.56"

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-24.50 hrs, dt= 0.01 hrs
MA-Boston 2-Year Duration=1,440 min, Inten=0.13 in/hr

| Area (sf) | C | Description |
|---|---|---|
| 9,400 | 0.90 | Buildings and Pavement |
| 1,492 | 0.35 | Grass and Dirt |
| 10,892 | 0.82 | Weighted Average |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 6.0 | | | | | **Direct Entry,** |

## Subcatchment EXISTING: 143-145 Cedar Street Existing

Runoff = 0.04 cfs @ 0.10 hrs, Volume= 3,573 cf, Depth= 3.94"

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-24.50 hrs, dt= 0.01 hrs
MA-Boston 10-Year Duration=1,440 min, Inten=0.20 in/hr

| Area (sf) | C | Description |
|---|---|---|
| 9,400 | 0.90 | Buildings and Pavement |
| 1,492 | 0.35 | Grass and Dirt |
| 10,892 | 0.82 | Weighted Average |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 6.0 | | | | | **Direct Entry,** |

## Subcatchment EXISTING: 143-145 Cedar Street Existing

Runoff = 0.05 cfs @ 0.10 hrs, Volume= 4,466 cf, Depth= 4.92"

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-24.50 hrs, dt= 0.01 hrs
MA-Boston 25-Year Duration=1,440 min, Inten=0.25 in/hr

| Area (sf) | C | Description |
|---|---|---|
| 9,400 | 0.90 | Buildings and Pavement |
| 1,492 | 0.35 | Grass and Dirt |
| 10,892 | 0.82 | Weighted Average |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 6.0 | | | | | **Direct Entry,** |

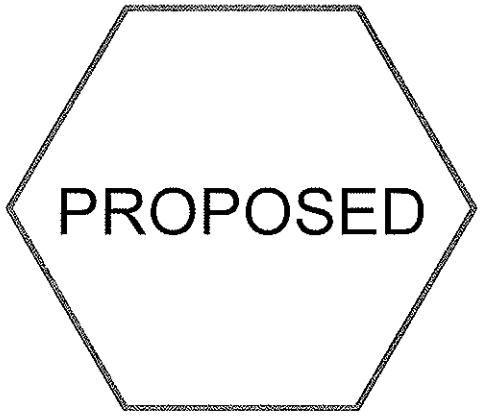
## Subcatchment EXISTING: 143-145 Cedar Street Existing

Runoff = 0.07 cfs @ 0.10 hrs, Volume= 6,252 cf, Depth= 6.89"

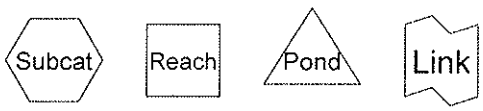
Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-24.50 hrs, dt= 0.01 hrs
MA-Boston 100-Year Duration=1,440 min, Inten=0.35 in/hr

| Area (sf) | C | Description |
|---|---|---|
| 9,400 | 0.90 | Buildings and Pavement |
| 1,492 | 0.35 | Grass and Dirt |
| 10,892 | 0.82 | Weighted Average |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 6.0 | | | | | **Direct Entry,** |




# 143-145 Cedar Street Proposed




Drainage Diagram for PROPOSED
Prepared by DESIGN CONSULTANTS, INC 12/23/2009

## Subcatchment 1S: 143-145 Cedar Street

Runoff = 0.51 cfs @ 0.08 hrs, Volume= 160 cf, Depth> 0.18"

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-0.18 hrs, dt= 0.01 hrs
MA-Boston 2-Year Duration=5 min, Inten=3.25 in/hr

| Area (sf) | C | Description |
|---|---|---|
| 8,578 | 0.90 | Buildings and Pavement |
| 2,314 | 0.35 | Grass and Dirt |
| 10,892 | 0.78 | Weighted Average |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 6.0 | | | | | **Direct Entry,** |

## Subcatchment 1S: 143-145 Cedar Street

Runoff = 0.77 cfs @ 0.08 hrs, Volume= 241 cf, Depth> 0.26"

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-0.18 hrs, dt= 0.01 hrs
MA-Boston 10-Year Duration=5 min, Inten=4.90 in/hr

| Area (sf) | C | Description |
|---|---|---|
| 8,578 | 0.90 | Buildings and Pavement |
| 2,314 | 0.35 | Grass and Dirt |
| 10,892 | 0.78 | Weighted Average |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 6.0 | | | | | **Direct Entry,** |

## Subcatchment 1S: 143-145 Cedar Street

Runoff = 0.96 cfs @ 0.08 hrs, Volume= 299 cf, Depth> 0.33"

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-0.18 hrs, dt= 0.01 hrs
MA-Boston 25-Year Duration=5 min, Inten=6.10 in/hr

| Area (sf) | C | Description |
|---|---|---|
| 8,578 | 0.90 | Buildings and Pavement |
| 2,314 | 0.35 | Grass and Dirt |
| 10,892 | 0.78 | Weighted Average |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 6.0 | | | | | **Direct Entry,** |

## Subcatchment 1S: 143-145 Cedar Street

Runoff = 1.34 cfs @ 0.08 hrs, Volume= 417 cf, Depth> 0.46"

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-0.18 hrs, dt= 0.01 hrs
MA-Boston 100-Year Duration=5 min, Inten=8.50 in/hr

| Area (sf) | C | Description |
|---|---|---|
| 8,578 | 0.90 | Buildings and Pavement |
| 2,314 | 0.35 | Grass and Dirt |
| 10,892 | 0.78 | Weighted Average |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 6.0 | | | | | **Direct Entry,** |

## Subcatchment 1S: 143-145 Cedar Street

Runoff = 0.03 cfs @ 0.10 hrs, Volume= 2,209 cf, Depth= 2.43"

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-24.50 hrs, dt= 0.01 hrs
MA-Boston 2-Year Duration=1,440 min, Inten=0.13 in/hr

| Area (sf) | C | Description |
|---|---|---|
| 8,578 | 0.90 | Buildings and Pavement |
| 2,314 | 0.35 | Grass and Dirt |
| 10,892 | 0.78 | Weighted Average |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 6.0 | | | | | **Direct Entry,** |

## Subcatchment 1S: 143-145 Cedar Street

Runoff = 0.04 cfs @ 0.10 hrs, Volume= 3,398 cf, Depth= 3.74"

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-24.50 hrs, dt= 0.01 hrs
MA-Boston 10-Year Duration=1,440 min, Inten=0.20 in/hr

| Area (sf) | C | Description |
|---|---|---|
| 8,578 | 0.90 | Buildings and Pavement |
| 2,314 | 0.35 | Grass and Dirt |
| 10,892 | 0.78 | Weighted Average |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 6.0 | | | | | **Direct Entry,** |

## Subcatchment 1S: 143-145 Cedar Street

Runoff = 0.05 cfs @ 0.10 hrs, Volume= 4,248 cf, Depth= 4.68"

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-24.50 hrs, dt= 0.01 hrs
MA-Boston 25-Year Duration=1,440 min, Inten=0.25 in/hr

| Area (sf) | C | Description |
|---|---|---|
| 8,578 | 0.90 | Buildings and Pavement |
| 2,314 | 0.35 | Grass and Dirt |
| 10,892 | 0.78 | Weighted Average |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 6.0 | | | | | **Direct Entry,** |

## Subcatchment 1S: 143-145 Cedar Street

Runoff = 0.07 cfs @ 0.10 hrs, Volume= 5,947 cf, Depth= 6.55"

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-24.50 hrs, dt= 0.01 hrs
MA-Boston 100-Year Duration=1,440 min, Inten=0.35 in/hr

| Area (sf) | C | Description |
|---|---|---|
| 8,578 | 0.90 | Buildings and Pavement |
| 2,314 | 0.35 | Grass and Dirt |
| 10,892 | 0.78 | Weighted Average |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 6.0 | | | | | **Direct Entry,** |

## APPENDIX B

Sewer Calculations
4:1 I/I Calculations

# SEWER CALCULATIONS

## I. INTRODUCTION

The following sewerage calculations are based upon 310 CMR 15.203, 314 CMR 7.15 and architectural floor plans provided by KDI.

## II. CALCULATIONS

| | |
|---|---|
| Number of Bedrooms | 20 (assumed) |
| Average Daily Flow (110 gal/day/bedroom) | 20 x 110gal/day |
| Peaking Factor | 5.5 |
| Total Peak Flow | 8.4 gal/min |
| Slope | 0.020 |
| Pipe Size | 6" |

## III. DESIGN

PVC pipe (Manning's roughness coefficient = 0.011) at the calculated slope and diameter is adequate for flows of 385 gal/min and less (see attached nomograph). The proposed design falls within acceptable limits.

## IV. CONCLUSION

Six-inch (6") PVC, SDR 35, ASTM D3034 is proposed for the sewer line.

# INFILTRATION/INFLOW REMOVAL CALCULATIONS

## I. INTRODUCTION

The following infiltration/inflow removal calculations are based upon 310 CMR 15.203, the sewer calculations presented above, and the storm drainage calculations summarized in Table I. The City of Somerville requires that infiltration/inflow removal of four times the proposed additional average daily sewer flow must be provided by the project.

## II. CALCULATIONS

| | |
|---|---|
| Existing Average Daily Sewer Flow | 525 gal/day |
| Proposed Average Daily Sewer Flow | 2,200 gal/day |
| Additional Average Daily Flow | 1,675 gal/day |
| Four Times Additional Average Daily Flow | 6,700 gal/ day = 0.010 cfs |

## III. REMOVAL

The required 0.010 cfs of infiltration/ inflow will be removed from the combined sewer system by peak flow reduction in the storm drainage from the site. Subtraction of the proposed flow rates from the existing flow rates given in Table 1 gives flow reductions of 0.03 cfs, 0.04 cfs, 0.05 cfs, and 0.07 cfs for the 2 yr., 10yr., 25 yr., and 100 yr. Storms respectively. All of these flow reductions exceed the required removal of 0.01 cfs.

## IV. CONCLUSION

Because the storm drainage flow reductions provided by the project exceed the required infiltration/inflow removal rate we conclude that the proposed design meets and exceeds the requirement for infiltration/inflow removal.

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JOB 2006-029 CEDAR ST.
SHEET NO. _____ OF _____
CALCULATED BY RCB DATE 12/23/09
CHECKED BY _____ DATE _____
SCALE _____

SEWER CALCS

EXIST.

| | | USE |
|---|---|---|
| #5 ALPINE | 1060 SF | WAREHOUSE |
| #143 CEDAR | 3,364 SF | WAREHOUSE |
| #145 CEDAR | 2,447 SF | WAREHOUSE |
| | 6,871 SF | WAREHOUSE |

WAREHOUSE ESTIMATED GPD IS BASED ON EMPLOYEES, WHICH IS UNKNOWN, THEREFORE COMMERCIAL OFFICE SPACE WILL BE USED

OFFICE = 75gpd/1000 SF SAY 75 x 7 = 525gpd

PROPOSED

6-10 UNITS PLANNED, SAY 10 UNITS @ 2 BEDS/UNIT

= 20 BEDROOMS @ 110gpd/BEDROOM = 2,200gpd

Δ = 1,675 gpd INCREASE